

# Advanced Simulation Capability for Turbopump Cavitation Dynamics Guided by Experimental Validation, Phase I

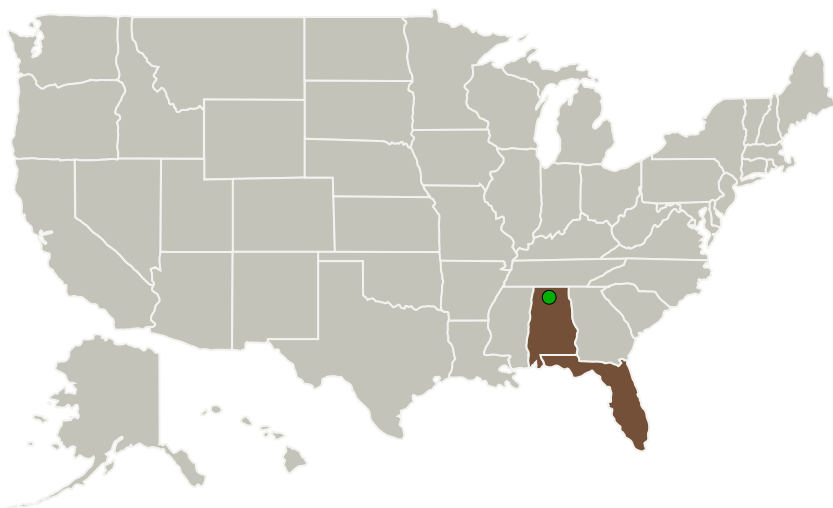
Completed Technology Project (2014 - 2014)



## Project Introduction

Numerical cavitation modeling capability is critical in the design of liquid rocket engine turbopumps, feed lines, injector manifolds and engine test facilities. Cavitation in turbopumps leads to reduced performance, mechanical vibrations, and component erosion. The Computational Fluid Dynamics (CFD) solver Loci-STREAM—developed by Streamline Numerics—is one of the primary production tools currently used at NASA to simulate turbopumps. With a long term goal of enabling accurate computational modeling of cavitating turbopumps subjected to an array of potential operating conditions, this project is aimed at enhancing the cavitation modeling capability in Loci-STREAM to enable time-accurate simulations involving complex engineering geometries present in turbopumps of relevance to NASA involving cryogenic fluids (LOX, LH<sub>2</sub>, LCH<sub>4</sub>, RP-1, RP-2). This will contribute to enhanced performance, reliability and reduced developmental costs of liquid rocket pumps. The project will involve a tightly coupled experimental/computational effort. The experimental simulations will be conducted at the University of Florida in a dedicated experimental facility capable of investigating various cavitation modes covering the entire range of non-cryogenic to cryogenic fluids; the proposed studies will be supported by extensive instrumentation. The cavitation models in Loci-STREAM will be substantively validated via dedicated experimental data directed by the computational and model requirements.

## Primary U.S. Work Locations and Key Partners



Advanced Simulation Capability  
for Turbopump Cavitation  
Dynamics Guided by  
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## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Streamline Numerics, Inc.	Lead Organization	Industry	Gainesville, Florida
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Florida

## Project Transitions

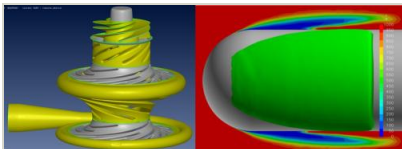
**June 2014:** Project Start

**December 2014:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137751>)

## Images



### Briefing Chart

Advanced Simulation Capability for Turbopump Cavitation Dynamics Guided by Experimental Validation, Phase I  
(<https://techport.nasa.gov/image/128909>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Streamline Numerics, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

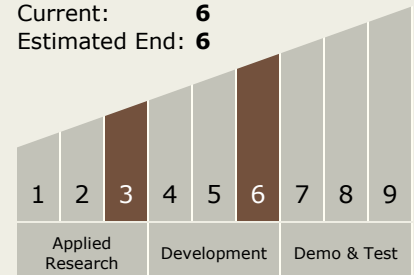
Carlos Torrez

### Principal Investigator:

Siddharth S Thakur

## Technology Maturity (TRL)

Start: **3**  
Current: **6**  
Estimated End: **6**



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## Technology Areas

### Primary:

- TX01 Propulsion Systems
  - └ TX01.4 Advanced Propulsion
    - └ TX01.4.3 Nuclear Thermal Propulsion

## Target Destinations

The Sun, Earth, The Moon,  
Mars, Others Inside the Solar  
System, Outside the Solar  
System